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MEMORANDUM R. A. PAGES

DATE: AUGUST 27, 1992

RE: CAL/EPA AIR RESOURCES BOARD: FINAL REPORT ON THE IDENTIFICATION OF FORMALDEHYDE AS A TOXIC AIR CONTAMINANT, JULY 1992

Background

A toxic air contaminant (TAC) is defined in the California Health and Safety Code § 39655 as "an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health." Evaluation of possible TACs is overseen by the Air Resources Board (ARB), part of the California Environmental Protection Agency (Cal/EPA). ARB staff prepare an exposure assessment and Office of Environmental Health Hazard Assessment (OEHHA) staff prepare a written evaluation on available health effects information. After a public comment period, all materials are formally reviewed by the Scientific Review Panel (SRP) at a public meeting. SRP then submits a written report to ARB.

ARB Final Report

Formaldehyde was identified as a TAC on March 12, 1992, by the ARB. However, due to written and oral comments, ARB and OEHHA staff were directed to work with industry to "make clarifications to" the initial report. The final report, reflecting those efforts, is dated July 1992. It consists of an executive summary and three volumes of supporting scientific information, the Technical Support Document (the volumes are exposure assessment, health assessment, and public comments and ARB/OEHHA responses). Following its identification as a TAC, formaldehyde will enter a "risk management" or "control" phase, during which a report on the need for and degree of control measures will be prepared.

Classification as a TAC

ARB's recommendation that formaldehyde be classified as a TAC was based on the following: (1) sufficient evidence that exposure to formaldehyde poses a public health hazard; (2) that formaldehyde is detected in ambient and indoor air and does not break down at a rate that would eliminate exposure; and (3) that formaldehyde is listed as a hazardous air pollutant by the federal government.

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Exposure

ARB determined that formaldehyde is produced by mobile sources (e.g., auto emissions) and by stationary and area sources (e.g., oil refineries). "Most" formaldehyde is formed via chemical reactions (photochemical oxidation) in the environment. An estimated mean statewide, population-weighted exposure of 4.4 ppbv (parts per billion volume in air) (or 5.4 $\mu g/m^3$) was calculated.

ARB also reported that formaldehyde concentrations inside residences range from 10-500 ppbv with means of 24 ppbv for offices, 50 ppbv for homes and 72 ppbv for mobile homes. The report stated "indoor inhalation is a significant portion of total exposure to formaldehyde."

In discussions of indoor environments, the report referred to cigarettes as a combustion source that "can also intermittently contribute to indoor levels of formaldehyde." (p. A-43) However, the report conceded that, while cigarettes can emit measurable amounts of formaldehyde, "combustion sources [also including gas appliances and kerosene heaters] do not appear to affect the average formaldehyde concentration inside the home significantly." (p. A49)

Health Effects

With regard to health effects, OEHHA concurred with IARC and EPA designations of formaldehyde as a probable human carcinogen, based on adequate in animals and limited epidemiologic evidence in humans. Many of the epidemiologic studies concern lung cancer, brain cancer and leukemia. Genotoxic/mutagenic and noncancer effects were also discussed. No teratogenic or reproductive effects were proposed. Again in agreement with an EPA designation, it was assumed that no threshold existed for formaldehyde.

Risk Estimates

Based on extrapolations from animal bioassays, OEHHA estimated an upper-bound risk of cancer from continuous exposure to 1 ppbv to range from $0.3\text{-}40 \times 10^{-6}$ per ppbv, or 1-40 cancers per million people exposed to 1 ppbv over a 70-year lifetime. The best value for unit risk was estimated at 7×10^{-6} per ppbv, or 7 excess cancers per million persons. Using the best estimate and dose rates for indoor and outdoor environments, OEHHA estimated 230 cancers per million persons for those exposed indoors and five cancers per million persons for those exposed outdoors. These translate to 7,000 and 150 in a population of 30 million, respectively.

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